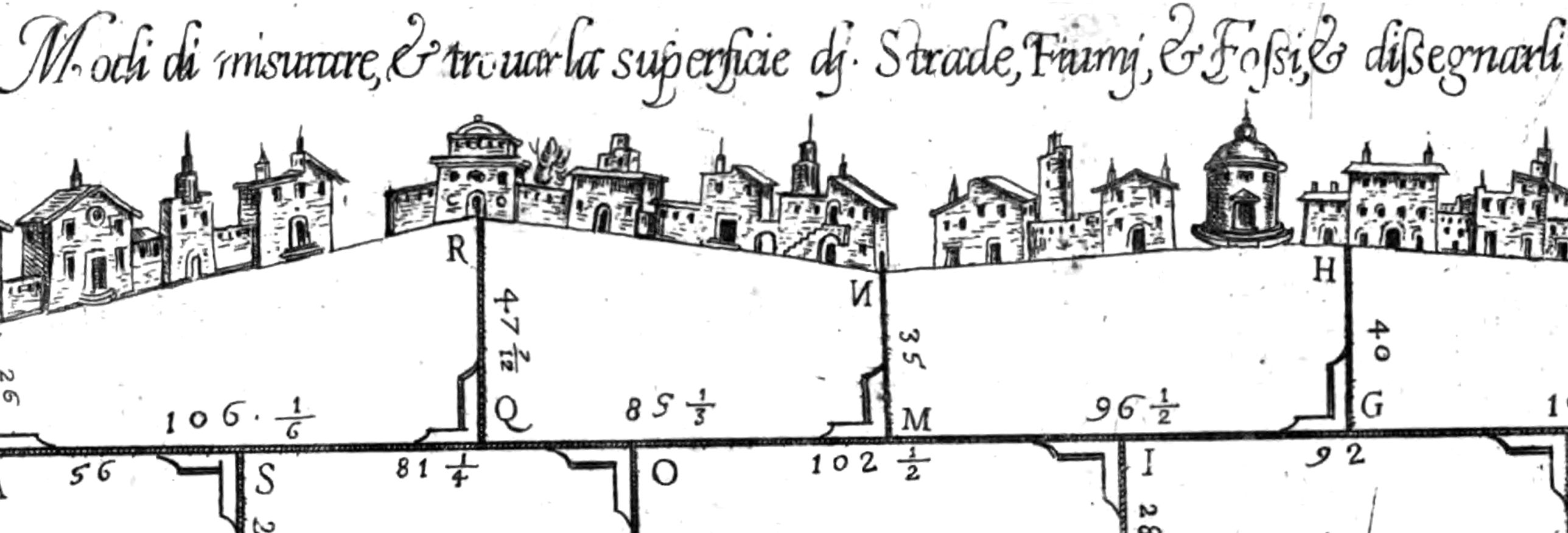
diségno 7.2020

unione italiana disegno
7.2020

diségno

ISSN 2533-2899

english version



diségno

7.2020

DRAWING AND MEASUREMENT

diségno

Biannual Journal of the UID Unione Italiana per il Disegno Scientific Society
n. 7/2020
http://disegno.unioneitalianadisegno.it

Editorial office
piazza Borghese 9, 00186 Roma
rivista.uid@unioneitalianadisegno.it

Cover
Pomodoro G. (1599). Geometria prattica, tratta dagl'elementi d'Euclide et altri auttori..., Roma: Stefano de Paolino. Tav. XXXIIII, detail.

The articles published have been subjected to double blind peer review, which entails selection by at least two international experts on specific topics.
For Issue No. 7/2020, the evaluation of contributions has been entrusted to the following referees:
Fabrizio Agnello, Piero Albisinni, Laura Baratin, Salvatore Barba, Marco Giorgio Bevilacqua, Carlo Bianchini, Fabio Bianconi, Maurizio Marco Bocconcino, Stefano Brusaporci, Marco Canciani, Cristina Càndito, Laura Carnevali, Andrea Casale, Emanuela Chiavoni, Alessandra Cirafici, Antonella di Luggo, Laura Farroni, Paolo Giordano, Carlo Inglese, Fabio Lanfranchi, Alessandro Luigini, Federica Maietti, Marco Muscogiuri, Leonardo Paris, Ivana Passamani, Fabio Quici, Michele Russo, Nicolò Sardo, Roberta Spallone, Graziano Mario Valenti.

English translations of the editorial and of the essays by Roberto de Rubertis, Francesca Fatta, Marco Gaiani, Ornella Zerlenga sono di Elena Migliorati.

Published in December 2019

ISSN 2533-2899

7.2020 **diségno**

Rules, Measurements, Geometries, and Underlying Compositions: Graphical/Interpretational Hypotheses Regarding the Holy House of Loreto

Alessandra Meschini

Abstract

This article presents the results of some studies of the Renaissance architectural/sculptural construction constituting the marble surface of the Holy House of Loreto. Detailed representations obtained from a survey using modern digital technologies served as the basis for specific in-depth graphical/analytical investigations of the monument. In particular, this article investigates the following aspects: the proportions of the Corinthian order, an architectural element on which the compositional design of the elevations is based; the proportional relationships among the parts of the capitals of the order compared to two studio drawings for the larger order of Saint Peter's in Rome deemed to be the work of Bramante; the copresence and correlation in the double rhythm that defines the architectural composition of the faces, echoing the motif of the triumphal arch and the consequent use of an alternating rhythm of two different inter-column spaces, considering as well the relationship with the module identified for the proportions of the order; correspondences with ancient systems of linear measurement in Roman 'great spans' and ancient Roman feet presumably adopted to design the marble surface; and the presence of underlying regulating traces, using the golden ratio to arrange the sculpted panels depicting the story of Mary, with particular attention to the low relief of the Annunciation made by Sansovino.

Keywords: exploratory drawing, proportional relationships, module/measurement, systems of measurement, regulating traces

Introduction

In 1507, Pope Julius II called Donato Bramante to Loreto, asking him to draft a project (for which unfortunately no drawings remain) for a marble cover [Grimaldi 1991, p. 44] to protect the relics of the presumed chapel of Nazareth (Holy House) [1]. The only related document found is a receipt for payment from 1510 referring to the realization of two wooden models commissioned from Bramante, one of which –called "modelo de la chapela di nostra donna"– seems to refer to the project for the marble ornamentation [Bruschi 1973, pp. 964, 965]. Andrea Contucci, known as the Sansovino, was called by Leone X in 1513 to replace Bramante for the moulded decoration of the Holy House from 1518 to 1527 [Bettarini, Barocchi 1966-1987, vol. IV, pp. 270-283]. When Sansovino died, the work passed into the hands of Raniero Nerucci and then to Antonio da Sangallo the Younger, who added the balustrade at the top (1536). Overall, the creation of this architectural/sculptural construction lasted about seventy years and saw the participation of numerous sculptors [2] from Sansovino's circle and beyond [Grimaldi 1999, pp. 400-409].

Bramante's project for the marble shell is composed of an architectural configuration based on the alternating rhythm of two different inter-column spaces articulated by sixteen Corinthian half columns situated on the corners and at defined intervals on the four façades. Four doors located centrally with respect to the larger inter-column areas on the north and south elevations allow access to the interior spaces of the chapel and the slab in the roof. Sansovino

found himself working as a continuer of this design approach (fig. 1). His language, however, tending towards intentions of strong interaction between sculpture and architecture, led him to work based on a strong sculptural/decorative interpretation of the architectural scans of the construction [Macchioni 1983, Vol. 28, pp. 551-558]. In particular, the space between the larger inter-columns was dedicated to a topic that, appropriately divided, involved all façades of the work: eight 'illustrations' narrating the life of the Virgin Mary sculpted within frames with a sage dose of low-high relief and set in perspective views [Ferri 1853, pp. 13-15]. In this respect, information exists about two models created in 1519-1520 that were taken to Rome [3] which possibly refer to a phase to modify the decorative apparatus that increased the number of sculpted panels [Grimaldi 1999, p. 44-72]. Sansovino personally realized the low reliefs of the '*Annunciation*', the first panel of the '*Wedding of the Virgin Mary*', and the '*Adoration of the Shepherds*'.

The geometric/architectural representation

The first known representations of the Holy House made with the intention of 'rendering' the relic relate to: plan drawings made by Bastiano da Sangallo, called 'Aristotile' (1533), an anonymous person from the first half of the Seventeenth century [4], and Johann Blaeu (1663); a drawing of the south façade by Francisco de Holanda (1538-1541); and the etchings made of all the faces by Giovanni Battista Cavalieri (1567-1568) [Grimaldi 1999, pp. 115, 116; p. 244]. The most exquisite from later centuries are the 'pseudo-orthogonal' representations by Pieter Mortier and Johann Blaeu (1705) [Grimaldi, 1999, pp. 118, 119] and the etchings made by Gaetano Ferri (1853) [Ferri 1853, Tav. XVI, XVII] (fig. 2). However, while constituting important documents, none of these depictions can be deemed an adequate graphical basis for conducting in-depth investigations about the 'measures' of the project.
Therefore, after careful evaluation of the complexity of the construction and the particulars of its placement, the decision was made to conduct an integrated digital survey using reality-based systems: laser-scanner acquisitions combined with modern photogrammetry (fig. 3). These choices were made both to obtain homogeneous data (point cloud) and, with regard to the method of rendering, to maintain scientific control of the procedure. These aspects have already been discussed in other paper [Meschini, Feriozzi 2017a, pp. 683-692]. Here we recall that the objective was to obtain exhaustive, verified representations of the monument to not only adequately render the overall formal complexity in suitable detail, but also support specific exploratory investigations (fig. 4).

Fig. 1. Photographic snapshots of the entire marble work: north-west corner, south-east corner.

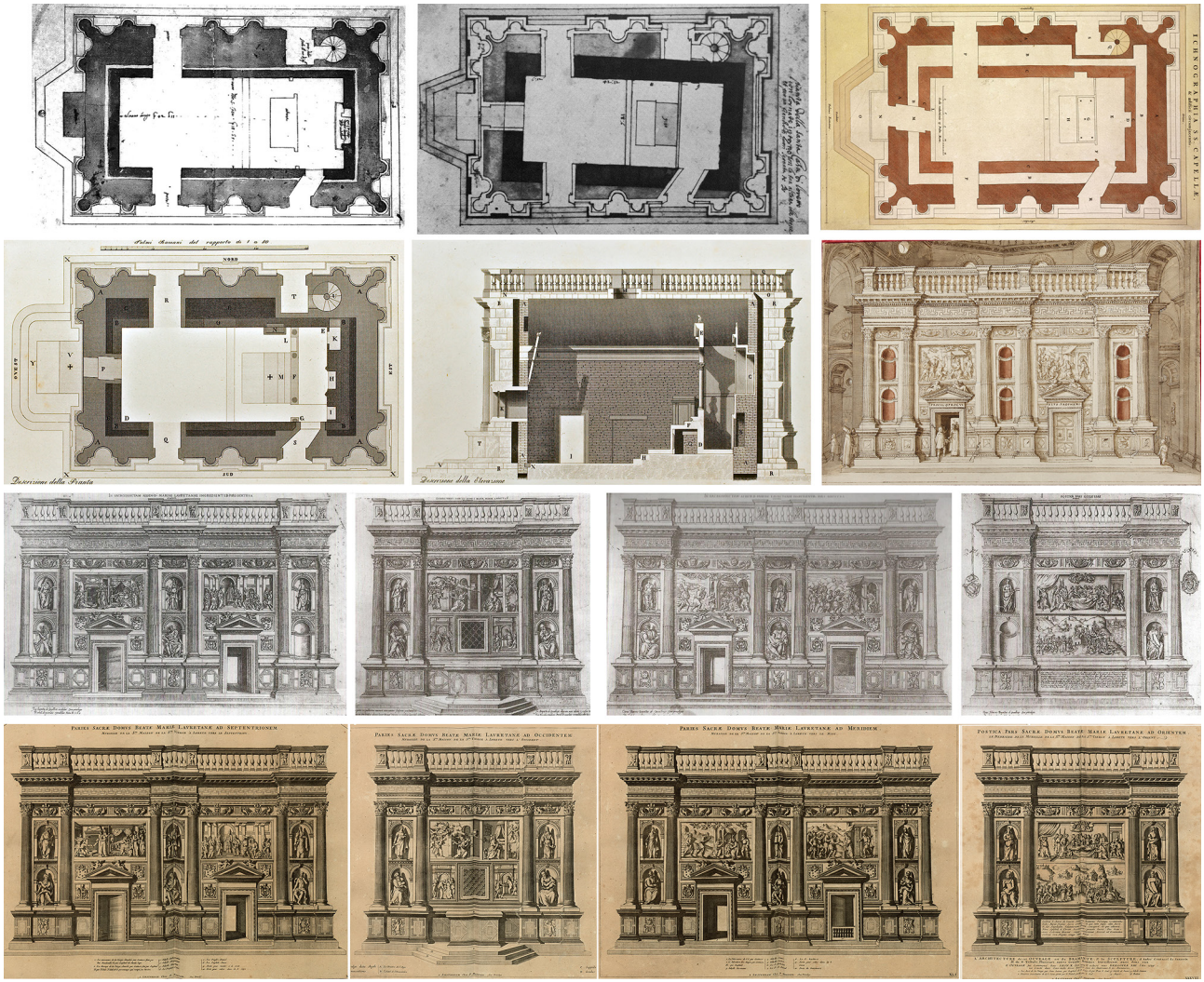
From representation to analysis: objectives and methodological basis

The main objective of the studies was to make various suitable, in-depth graphical/analytical observations regarding the proportions, composition, and measures of the construction.
The methodological arrangement adopted for these investigations were based on historical studies and related theoretical reflections primarily referring to the concept of 'imitation', that is, a practice considered during the Renaissance to be at once both inevitable and desirable. In the field of architecture, this look towards the past entailed studies of both the ruins of antiquity and architectural writings, where the only known ancient treatise on architecture –despite the enigmatic terms and illustrations that have been lost– was De architettura by Marco Vitruvio Pollione. In both cases, the imitation of predecessors represented a model, a method to learn from. In this sense, the treatise De re aedificatoria by Leon Battista Alberti (1st ed. 1485), which follows Vitruvius in its overall structure and view of ancient models, can be defined as creative imitation of the ancient treatise by Vitruvius [Ackerman 2003, pp. 109-121].
Bramante and Sansovino worked at Loreto in the early 1500s. During this period, architectural orders were studied in Vitruvius' text –or at most in Alberti's treatise– and in a wide range of ancient architecture, though these sources were often reworked, as testified by the large number of drawings of Roman ruins which the architects, more than carefully representing them, reread as a function of their own interests. At heart, even Vitruvius, in special dimensional, contextual situations, allowed small adjustments, so the architects tended to design their works not only inspired by ancient models, but also looking for a personal balance between 'decorum' (convenience) and 'licence' (freedom) [Ackerman 2003, pp. 153-200].

The study of the corinthian order and detail elements

The Corinthian order undoubtedly constitutes the architectural element on which the compositional design of the marble work is based, in that it determines both the 'dimensions' in elevation and the rhythmic layout of the façades, and therefore the two different lengths of the sides. The first topic investigated regarded the proportions of this architectural order, considering the bottom diameter of the shaft as a reference module. Although the order is composed of half columns, this does not invalidate either the identification of the module or the proportional logic of the parts.
The order was used complete with its three main parts (pedestal, column, entablature), starting with a base of three steps constituting a crepidoma that, as in classical architecture, lifts the plane of access to the chapel, alluding to the sacredness of the place.
The pedestal of the order (plinth, dado, cymatium) is based on about 3 modules, but if the crepidoma is also considered (about one module), the plane on which the column bases rest is situated at a height of about 4 modules with respect to the level of the church floor. The column (base, shaft, capital) is based on 10 modules. In other words, with respect to what Alberti indicated, it would seem slenderer by half a module. However, it should be noted that in the compositional arrangement of the work, an additional plinth is present (1/3 module) between the pedestal and the base of the column. Therefore, the slight increase in height may be due to this element, while the proportions of the shaft of the column remain based on about 8 modules. Finally, the entablature (architrave, frieze, cornice) seems to perfectly respect the proportions of 2 modules, 22.5 minutes as suggested by Alberti [Alberti, Bartoli 1550, pp. 216-226, pp. 250-257, pp. 286-294] (fig. 5).
Assuming that the project for the architectural partitions of the ornamentation can be attributed to Bramante, another investigation aimed to verify if the proportional relationship between the parts of the capital of the order could be compared to those in two studio drawings for the larger order of Saint Peter's in Rome, regarded by Frommel as the architect's work [5]. The latter echoes the division into seven parts recommended by both Vitruvius and Alberti: two parts for both rows of leaves and for the zone of the spirals, one part for the abacus. The comparison shows that the proportions are practically overlapping. Likewise, the representations arising from the survey were compared with some drawings, perhaps ornamentation surveys, made around the 1540s and attributed to Aristotile da Sangallo [6]. These representations show architectural details where the ratios between the elements and mouldings constituting the following portions of ornamental detail can be read: entablature, base of the column, and cymatium of the pedestals. In

Fig. 2. Above: plans by B. da Sangallo (1533), Anonymous (17th cent.) and J. Blaeu (1663); plan and section by G. Ferri (1853), south elevation by F. de Holanda (1541). Below: elevations by G. B. Cavalieri (1567) and P. Mortier and J. Blaeu (1705).

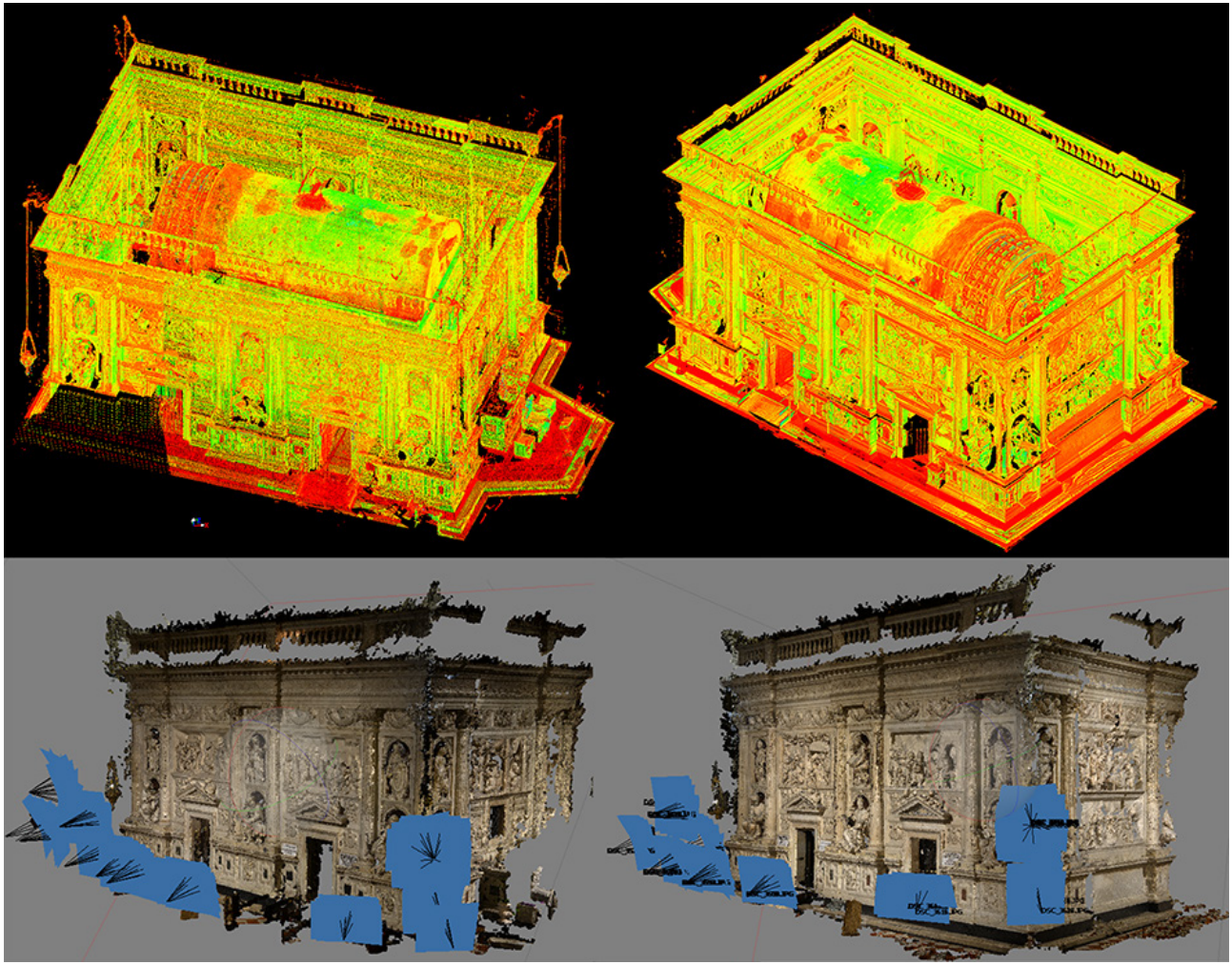


this case, while the clear margin of correspondence in the comparison attests to the mastery of the stonecutter, it also shows the reliability of the results of the survey, even on the detail scale (fig. 6).

The motif of the triumphal arch and the rhythmic inter-column spaces

The outer perimeter of the Holy House created by placing the new marble surface against the wall of the ancient chapel is almost rectangular [7], and the main compositional divisions of the design in elevation on opposite ends are identical. Therefore, the reasoning described below can be applied to two (major and minor) of the 4 faces.
The double rhythm that defines the architectural composition of the marble work is based on the repetition of two related themes: echoing the motif of the triumphal arch and the consequent use of 'rhythmic' alternating pairs of half columns interposed with niches. These themes were already used by Bramante in his 1503-1504 project for the Cortile del Belvedere, particularly the small façade of the nymphaeum and the north end of the portico of the upper garden. In addition to highlighting the reference to models of the Imperial era, this also testifies to the probable influence of Alberti's façade of Sant'Andrea in Mantua, the first model to use a series of two different inter-column spaces inspired by the very scheme of the Roman triumphal arch with a single arch between stone septa [Frommel 2003, pp. 106-109] (fig. 7).
On the minor fronts, this revisited reference can be read easily: with respect to a vertical axis of symmetry, the pairs of half columns close the ends of the elevations, ideally constituting piers of a triumphal arch where the low reliefs narrating the story of Maria stand in lieu of the arch. On the larger façades, the theme is duplicated, but not with a simple side-by-side repetition, which would have doubled central of the paired half-column layout non-aesthetically. Rather, it is mirrored with respect to an axis of symmetry placed at the centre of the pair opposite the one on the corner. In other words, for these elevations, a double vertical axis of symmetry could also be defined, but with a superposition in the middle of the right and left ends of this repeated theme (triumphal arch with an alternating rhythm of two different inter-column spaces). These aspects were the object of another analytical investigation that also considered the relationship with the module identified for the order's proportions.
Above all, an investigation of the theme of the triumphal arch that defines the partition of the major faces showed that the axes of the external columns of the pairs coincide almost perfectly with the vertical sides of a square equal to the number of modules (about 16) which proportion the layouts of the order starting with the stylobate. Within this square, a series of simple partitions can then be identified. With respect to these, some specific portions of the elevation drawing seem to be arranged. For example, the doors to access the interior chapel are located on the middle vertical axis (in place of the arches). As well, the elevation scan is arranged with respect to a four-part division of the side of a square whose upper quarter encompasses capitals and entablature, the two central quarters define the area that frames the system of stacked niches, and the lower quarter includes the rest of the work down to the grade plane of the step that constitutes the stylobate. Some studies of the Cortile del Belvedere (1503-1504) have also found that a square grid was probably used to divide the size of the loggia bays of the upper garden [Frommel 2003, p. 108].
In addition, if two circles are centred on the lower corners of the square with radius equal to the definable height at the upper limit of the architrave, we see that these intersect the plane of the stylobate at the axes where the stacked niches are arranged. Their point of intersection above also intercepts the centre of the upper limit of the rectangular panel dedicated to the low relief and constitutes the upper vertex of an equilateral triangle with sides equal to the distance between the axes passing through the keystones of the niches.
The longitudinal organization of the major elevations appears to be arranged on a division of the parts referring to dimensions proportional to the module, but maintaining a connection with the theme of the triumphal arch: 5 parts to both the left and right of the axis of the square defined before, traceable to a measurement equal to 1 3/4 of a module. Within this layout, both the decorations that embellish the lower part of the pedestals and the interposed tiles and the span of the arches of the niches seem to be defined. In addition, the total length of the major elevations, measured to the height of the dado of the pedestals, that is, the larger plinth situated below the base of the columns, is proportional to about 30 modules (15 to the axis of symmetry of the elevation). Finally

Fig. 3. Above: point cloud from the laser scanner survey. Below: point cloud from photogrammetric processing.



considering other elements in the elevations, other dimensional relationships can be traced out using the size of the module (fig. 8a).
On the minor façades, the analysis is enriched with further findings. In fact, by comparing the elevations to the square previously traced out by matching its median axis with the symmetry axis of these faces, it can be seen that the vertical sides of the square define the outer limits of the division that frame the niches between the pairs of half columns. The width of the triumphal arch theme is clearly enlarged, but this is not due to an increase in space between the pairs of half columns –exactly the same as that of the major elevations– but rather to the central area dedicated to the sculpted panels. As a result, the orders that close the edges of the faces to the right and left fall outside the square. However, if we consider an equilateral triangle inscribed within the square and represent the two circles centred on the lower corners of the square with a radius equal to the side of the triangle, we observe that at the bottom, these intersect precisely the right and left extremes of the step of the stylobate. This thus identifies the dimensional sub-units within which the

Fig. 4. The two-dimensional representations of the Holy House obtained from the integrated digital survey, the 3D model of the architectural layout and perspective cross section from the model.

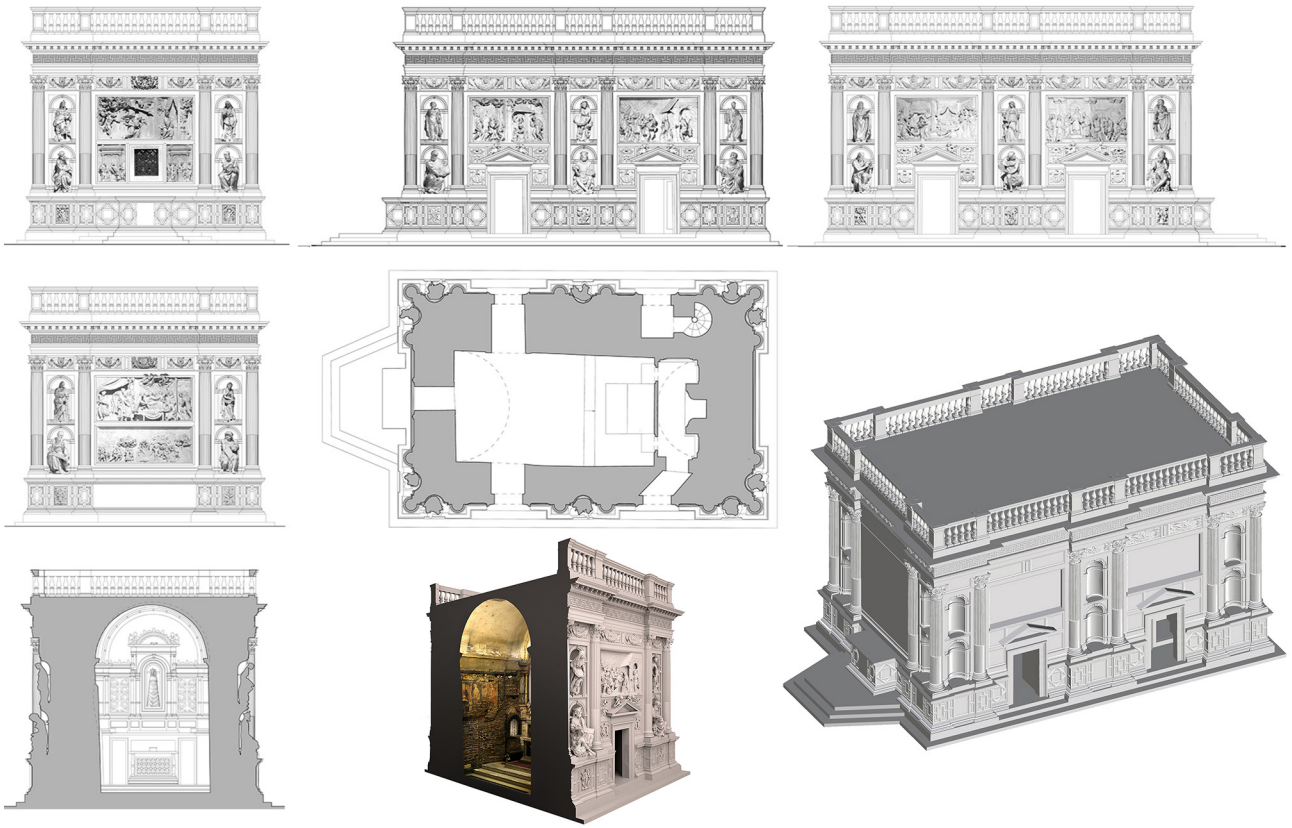
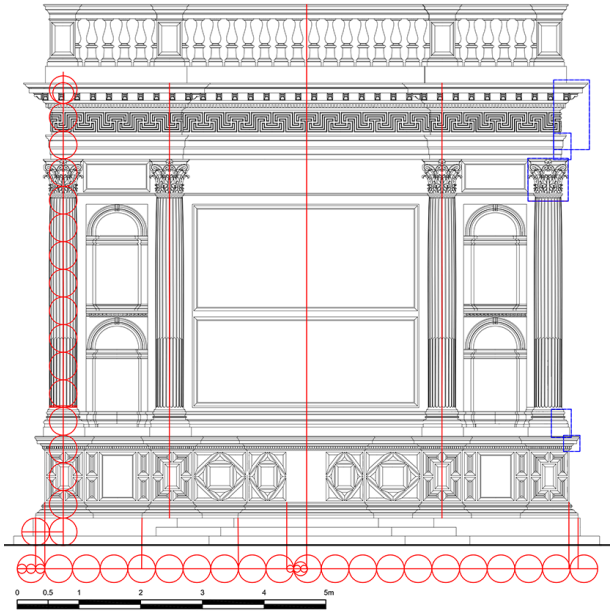


Fig. 5. Study of the proportions of the façades in relation to the module of the Corinthian order.



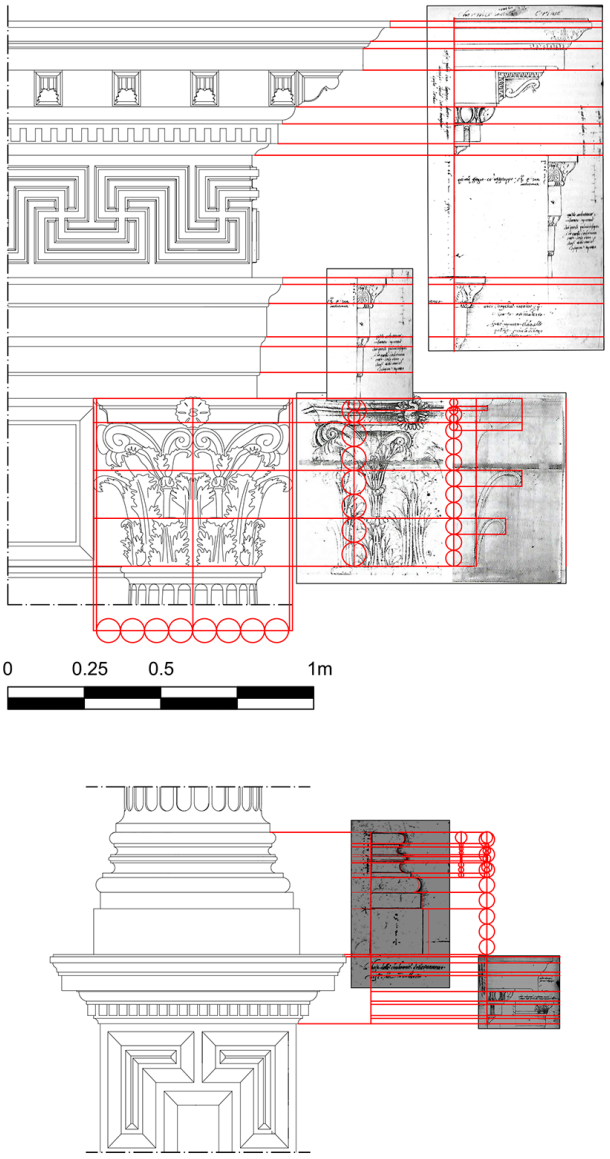
orders on the ends of the façades are perfectly contained. With regard to agreement between the geometrical investigation and the modular proportioning, most of the observations already seen for the major elevations are still valid, with the difference that with respect to dividing the horizontal side of the square into four parts, the two central quarters coincide with the partition dedicated to the low reliefs, which on these faces correspond to a width of 8 modules instead of 6.5 modules. The length of the minor elevations at the height of the dado of the pedestals is contained in 19 modules (fig. 8b).

The measurement systems of the project

The graphical documents found relating to the entire Basilica and the Holy House in particular report measurement scales in Roman spans. Historical information indicates that Bramante, in the same period (1507-1509) as his assignment in Loreto, was also active in Rome where he received commissions for his most important works and where the remains of ancient Rome certainly had a great influence on him. Likewise, Sansovino, in the years immediately preceding his call to Loreto, stayed in Rome for a decade (1504-1513), receiving prestigious commissions [8] in which he was able to create his soft interpretation of the sculptural work that is also found in the Holy House. He also was presumably able to study the ruins of ancient Rome.
The overall length of the elevations of the Holy House resulting from the survey are 13.695 m (major fronts) and 8.82 m (minor fronts) measured at the cymatium of the pedestal, that is, 13.40 m and 8.525 m if measured at the base of the columns of the order. The overall height is 8.76 m.
Starting with the historical data and survey, interest lay in investigating the correspondences with the ancient linear systems of measurement presumably used to design the marble work. In his in-depth studies on Bramante's projects (Saint Peter's, Cortile del Belvedere), Frommel refers to both Roman spans and ancient Roman feet [Frommel 1994, pp. 399-423]. Therefore, following this eminent example, the analysis was conducted by overlapping two different grids in these measurement systems on representations of the elevations [9].
The graphical investigation showed that the dimensions of the smaller elevations –in width considering the maximum

lateral overhang of the crepidoma and in height from the ground to the sky– correspond to a grid of 42 spans, 45 minutes x 39 spans, 13 minutes. However, considering the dimensions excluding the overhang of the first step of the crepidoma and the balustrade added in 1536, all the architectural layouts fall within a grid in rounded dimensions of 40 x 33 spans.
Investigating the elements more in detail, different references can be highlighted with the system in Roman spans. With regard to the width, the decorative arrangement of the pedestals, the geometric panels, and the figurative low-relief tiles alternate widths corresponding to about 3, 5, and 4 spans. The altar, placed in the middle of the west elevation, can be framed in a width of 10 spans, including the overhangs. The extension of the architrave and the balustrade at the top correspond to 38 spans, while the largest inter-column space, measured at the axis of the shafts of the columns, is 20 spans. There are other correspondences in elevation. The three steps of the crepidoma correspond to 2 spans and the pedestals correspond to 6 spans, of which the four central ones coincide with the dado. The order measures 20 spans (2 spans for the base, 13.5 spans for the shaft, and 2.5 spans for the capital); the entablature is included in the remaining 5 spans, 45 minutes. The niches between the pairs of columns are framed in 4.5 spans x 8 spans (ratio of about 1:2), while the area dedicated to the sculptural low reliefs corresponds to 16 spans x 8 spans (2:1 ratio) for the one at the top and 16 spans x 6 2/3 spans for the one at the bottom (ratio close to 2.5:1) (fig. 9, left).
If instead a foot-sized grid is created and the same aspects are analysed, the following can be noted: the dimensions of the elevations, width by height, measure a total of about 32 feet x 29 3/5 feet, that is, about 30 feet x 24 3/4 feet if we exclude the first step of the crepidoma (overhang and height) and the final balustrade. The analysis of the width measurements shows that: the decorations placed at the height of the pedestals alternate divisions of about 2 and 3 feet; the width of the altar, including the overhangs, corresponds to 7.5 feet; the extension of the architrave and balustrade corresponds to 28.5 feet, the major inter-column distance, measured from the axis of the orders, is 15 feet. Finally, the framing of the niches is about 3.5 feet x 6 feet, while the areas dedicated to the low reliefs are included in frames of 12 feet x 6 feet at the top and 12 feet x 5 feet at the bottom. Regarding in height measurements, the three steps of the crepidoma correspond to 1.5 feet, the

Fig. 6. Study of the proportional relationships between the detail elements of the capital, entablature, base of the column, and cymatium of the pedestals in relation to historical graphical sources.

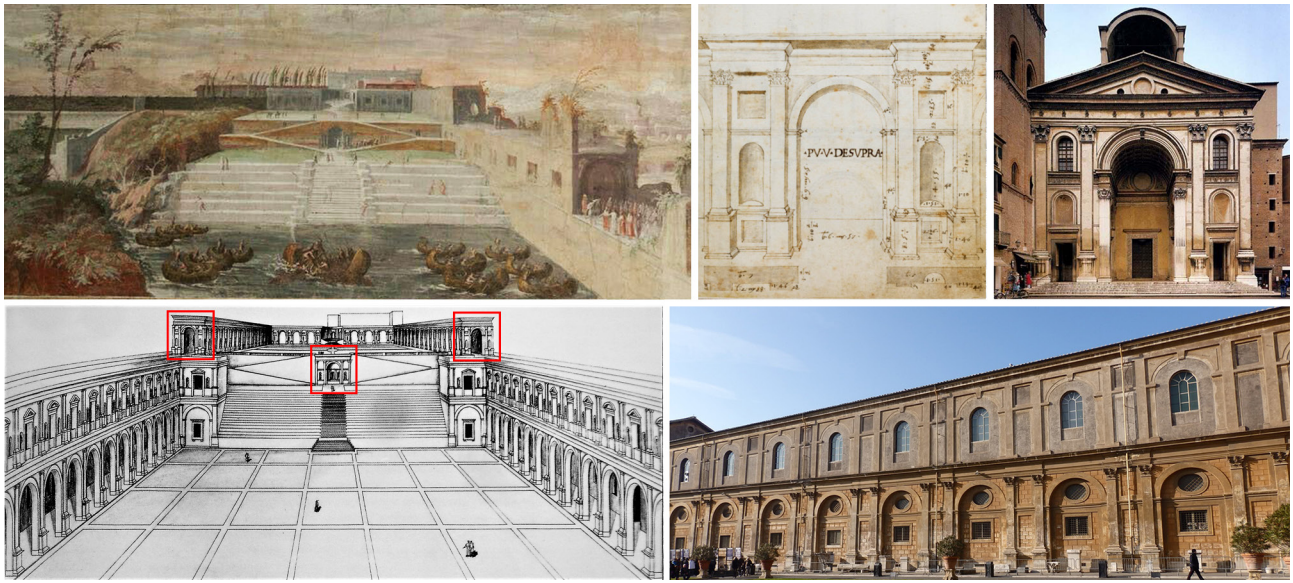


pedestals to 4.5 feet, the order to 15 feet (base: 1.5 feet; shaft: 11.5 feet; capital: 2 feet), and the entablature to 4 2/7 feet (fig. 9, right).
As for the major elevations, these measure 62 spans (i.e. 46 1/3 feet) in width if the overhang of the stylobate is excluded and 65 spans (i.e. 48 1/7 of feet) if it is included. Therefore, considering the measures in height including the lower step of the crepidoma (33 spans, 20 minutes) seen above, the overall dimensions are very close to a 2:1 ratio. For the rest, most of the layouts already seen for the minor elevations are repeated. In addition, the opening of the doors to access the inner parts of the chapel measure 4 spans, 45 minutes x 9 spans (approx. 1:2). The elements of the cornice, architrave, and triangular tympanum placed above the doors follow the alignments of the divisions into decorative panels that characterize the areas dedicated to the low reliefs (fig. 10).
It seems clear that the results obtained by overlapping the two different grids show a predominance of whole measurements in the case of the span and that this therefore could presumably have been the unit of measurement adopted.

The regulating traces in the 'Annunciation' panel

The concept of measurement does not pertain only to the practical expedient that defines physical sizes such as linear units of reference. Particularly during the Renaissance, this concept was also expressed in terms of underlying geometrical relationships and references to the golden number. Therefore, a further analysis aimed to verify the existence of regulatory traces supporting the layout of the sculpted panels by investigating in particular the 'Annunciation' by Sansovino.
The low relief measures 3.00 m x 1.47 m and elements and characters typical of religious iconography related to the biblical episode can be recognized. The observation of

Fig. 7. Above: Perin del Vaga (c. 1545), fresco of the Cortile del Belvedere with Naumachia (Castel Sant'Angelo, Rome) from: <http://www.scalarchives.it/web/>; Bernardo della Volpaia, Codice Coner, drawing of a span of the loggia in the garden (Soane's Museum, London) from: <http://collections.soane.org/THES83854>; Alberti, façade of Sant'Andrea in Mantua. Below: hypothetical reconstruction of the 1503-1504 project for the Belvedere (drawing by S. Gress and G. Diller) from Frommel 2003, p. 104; photo of the upper garden of the Cortile del Belvedere.



these aspects guided the investigations, leading to some hypotheses about the geometrical/proportional systems on which the composition of the arrangement of spaces and constituent elements of the scene seems to rest.
In fact, the combination of a series of golden rectangles placed side by side in different ways has been traced as a possible support to divide the three scenic spaces in the sculpted representation: two golden rectangles situated upright and next to each other along their long side define the proportions of the first scenic space, while the two following scenes in the story are composed within two other golden rectangles placed horizontally one above the other. The latter proportions ensure that the space delimited between the two flats defining Mary's house are built upon two overlapping squares and therefore the third and last space is in turn composed again of two golden rectangles, this time abutting along a shorter side.
Further special relationships were also found between the characters in the scene: the angel's posture follows the inclination resulting from the construction of a golden triangle whose vertex points towards the Virgin's womb and the inclination of the lightning that materialises the divine transmission of the Holy Spirit towards the Virgin also corresponds to the side of the golden triangle.

Finally, by overlapping an image of the low relief on the plan of the Holy House, one notes that its dimensions seem to correspond to those of the internal area of the chapel and that the figural partition of the three scenic spaces in the low relief corresponds to the division of the interior spaces composed of the prayer area, the altar area, and the area of the holy fireplace in the background (fig. 11).
The investigation of the perspective layout of the composition, made with inverse rendering procedures for a hypothetical 3D reconstruction of the space has already been specifically addressed in another paper [Meschini, Feriozzi 2017b, pp. 1-11].

Conclusions

As often happens in an analytical process, some investigations lead to others, that is, further investigations could be addressed, but this would require more space than the present essay allows. What was described herein can therefore obviously be extended. However, since many specific considerations have already been made addressed in detail in the treatment of the individual analyses, this closure aims to summarise more general aspects.

Fig. 8. Analysis of geometric findings between the architectural layout of the marble work and the theme of the triumphal arch (blue) with the relative relationship with the system of modular proportioning (red): a) east elevation, b) south elevation.

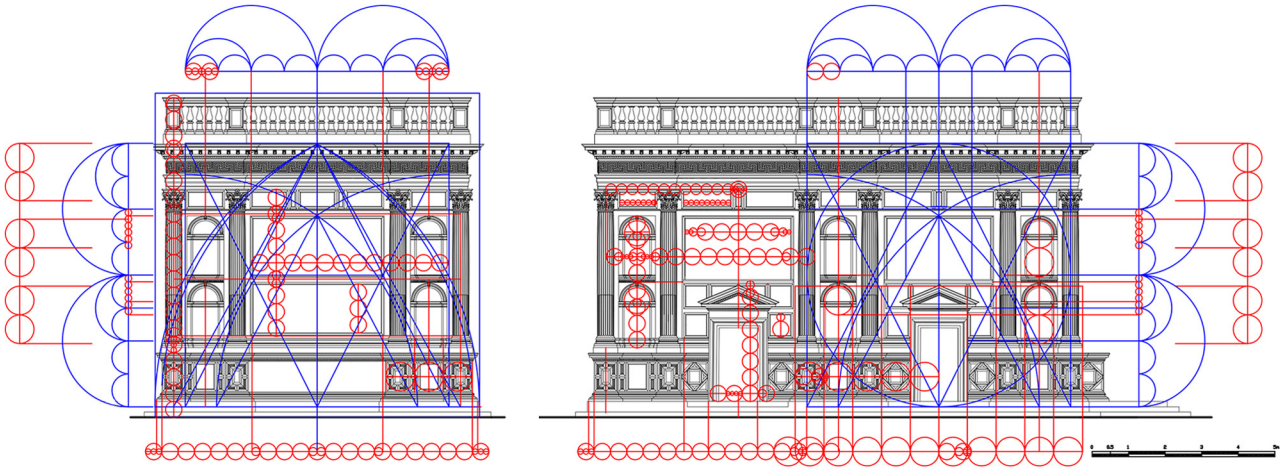
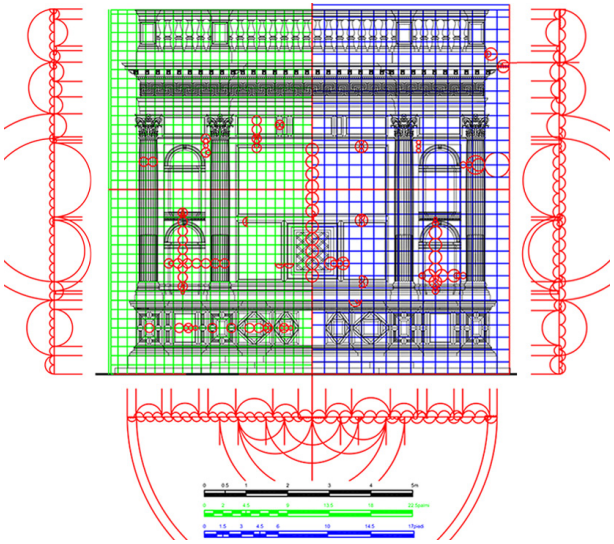


Fig. 9. Investigation into the ratio of correspondence between the elements of the minor façade composition and ancient linear measurement systems in spans (green) and feet (blue).



The analyses aimed to investigate the different meanings of the concept of measurement: in terms of the 'measurement module' (diameter of the bottom of the shaft) or proportions of the Corinthian order that define and 'size' the design of the elevations; in terms of the compositional partitions of the elevations, i.e. the repetition of themes (the 'rhythmic' alternation of two different inter-column spaces and the echo of the triumphal arch motif); in terms of physical quantities as a unit of measurement; in terms of the underlying geometrical relationships and the regulatory traces (sculptural panels).
Aside from evidencing how Bramante was an eminent connoisseur of the ancient world who drew inspiration from the models of the Imperial era, these studies overall seem to demonstrate that he granted himself licence with respect to the ancient prototypes [Frommel 2003, p. 100, 108], adapting certain proportions of the design of the Holy House to the particular situation. In other words, while at times conforming more with Vitruvius or more with Alberti, it is assumed that he aimed to give concrete form to his vision of 'old-fashioned' architecture through further invention [Frommel 1994, pp. 410-417].
Likewise, with regard to Sansovino, in the years in which he works at Loreto, treatises dedicated to the figurative arts such as *De Prospectiva Pingendi* by Piero della Francesca

Fig. 10. Analysis of the correspondence of the major façade with the sizing in spans (green), feet (blue), and other modular scans of the architectural composition.

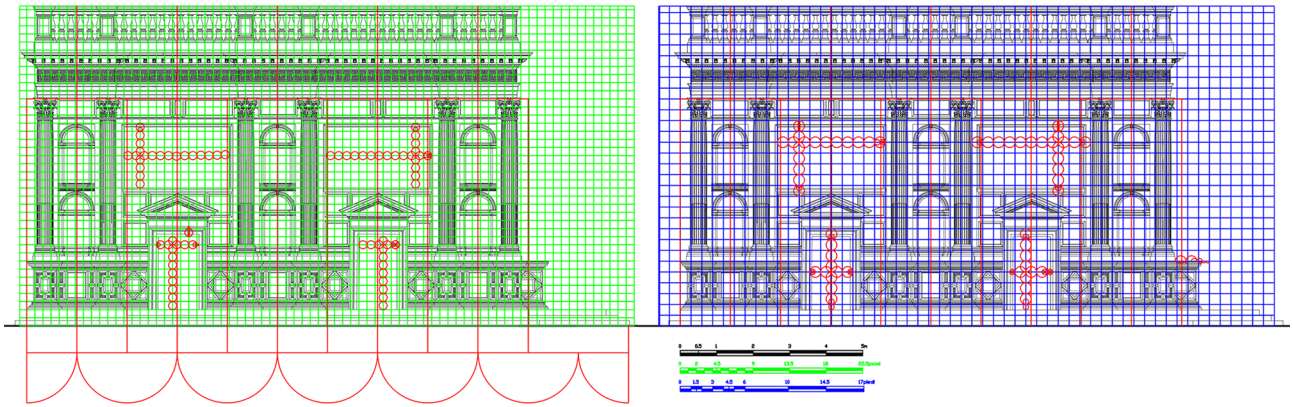
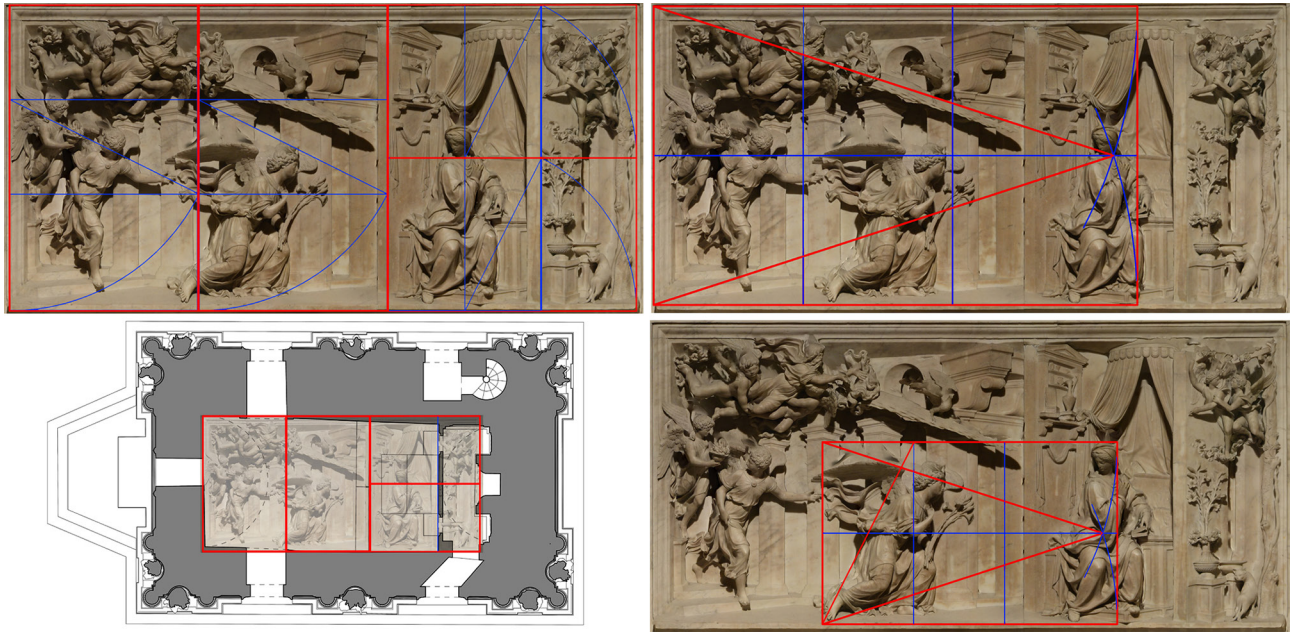


Fig. 11. The sculpted panel of the Annunciation: regulating traces in golden proportions of the frames of the scene, relationships of golden triangles between the characters, ratios between the low-relief dimensions and the interior space of the chapel.



and *De Pictura* and *De Statua* by Alberti had already been published. The analysis of the panel of the Annunciation seems to confirm not only the artist's knowledge of these writings, but also how much he succeeded in achieving that connection between the characters and the scenic spaces of the representation by applying underlying golden ratios and the dictates of perspective. These compositional expedients, although analysed for a specific panel, can be found in the planning of all sculptural panels that embellish the construction.

Notes

[1] According to ancient tradition, the interior of the Holy House constitutes the terrestrial home of the Virgin Mary, situated before a cave that is still venerated in the Basilica of the Annunciation in Nazareth.

[2] To cite a few: Niccolò Pericoli detto il Tribolo, Baccio Bandinelli, Raffaello da Montelupo, Girolamo Lombardo, Francesco di Vincenzo da Sangallo, Domenico Aimo. Then for the statues (sibyls and prophets), the brothers Giovan Battista and Tommaso della Porta and Aurelio and Girolamo Lombardi.

[3] ASSC Loreto, Depositario 4, 1516-1520, c.137 and c.174.

[4] Stored at the Albertina Graphische Sammlung in Vienna.

[5] GDSU 6770A. Frommel 1994, p. 609. Sheet 295.

[6] GDSU 1744A and 1746A: <https://euploos.uffizi.it/inventario-euploos.php> (accessed Octobre 10, 2020).

[7] The difference between the lengths of the opposite sides is of the order of 0.004 m (major elevations) and 0.007 m (minor elevations).

[8] This alludes to the funeral monuments that Sansovino created for Cardinal Manzi (Basilica of Santa Maria in Ara Celi) and for the cardinals Ascanio Sforza and Girolamo Basso Della Rovere (Church of Santa Maria del Popolo).

[9] For the span (great span), reference is made to the *palmus major* or *Dodrans* (¾ of a foot) which corresponded to the distance between the tip of the thumb and the tip of the little finger holding the fingers apart; a span was divided into 60 minutes.

Author

Alessandra Meschini, School of Architecture and Design "Eduardo Vittoria", University of Camerino, alessandra.meschini@unicam.it

Reference List

Ackerman, J. S. (2003). *Architettura e disegno. La rappresentazione da Vitruvio a Gehry*. Milano: Electa.

Alberti, L. B., Bartoli, C. (1550). L'architettura di Leon Batista Alberti. Tradotta in lingua Fiorentina da Cosimo Bartoli Gentil'huomo et Accademico Fiorentino. Firenze: Appreffo Lorenzo Torrentino: <http://architectura.cesr.univ-tours.fr/traite/Images/LES1505Index.asp> (accessed October10, 2020).

Bettarini, R., Barocchi, P. (a cura di). (1966-1987). *Vasari Giorgio. Le vite de' più eccellenti pittori scultori e architettori nelle redazioni del 1550 e 1568*. Vol. IV, pp. 270-283. Firenze: Sansoni.

Bruschi, A. (1973). *Bramante Architetto*. (II Ed.) Bari: Laterza.

Ferri, G. (1853). *La Santa Casa di Nazareth e la città di Loreto*. Macerata: Gius. Cortesi.

Frommel, Ch. L. (1994). San Pietro. In H. Millon, V. Magnano Lumpugnani (a cura di). *Rinascimento da Brunelleschi a Michelangelo. La rappresentazione dell'architettura*, pp. 399-423. Milano: Bompiani.

Frommel, Ch. L. (2003). I tre progetti bramanteschi per il Cortile del Belvedere. In *ID. Architettura alla corte papale nel Rinascimento*, pp. 89-155. Milano: Electa.

Grimaldi, F. (a cura di). (1991). *Il sacello della Santa Casa di Loreto. Storia e devozione*. Loreto: Cassa di Risparmio di Loreto.

Grimaldi, F. (a cura di). (1999). *L'Ornamento Marmoreo della Santa Cappella di Loreto*. Loreto: Delegazione Pontificia per il Santuario della Santa Casa di Loreto.

Macchioni, S. (1983). voce Contucci Andrea Detto il Sansovino. In *Dizionario Biografico Degli Italiani*, XXVIII, pp. 551-558. Roma: Treccani.

Meschini, A., Feriozzi, R. (2017a). Dal rilievo laser scanner al modello 3D di manufatti scultoreo-architettonici: la Santa Casa della Basilica di Loreto. Proposta di metodo per l'elaborazione di superfici poligonali complesse. In A. Di Luggo et al. (a cura di). *Territori e Frontiere della Rappresentazione,* Atti del 39° Convegno Internazionale dei docenti delle discipline della Rappresentazione, Napoli 14-15-16 settembre 2017, pp. 683-692. Roma: Gamgemi.

Meschini, A., Feriozzi, R. (2017b). The Perspective System Underlying the Low Relief of Sansovino's Annunciation. For a Narration of the Illusory Space of the Scene. In A. Luigini et al. (a cura di). *Proceedings of International and Interdisciplinary Conference IMMAGINI?*, vol. 1(9), 955, . Bressanone 27-28 novembre 2017, pp. 1-11. Basel (Switzerland): MDPI Press.